

Redescription of *Rhipidocotyle galeata* (Rudolphi, 1819) (Digenea, Bucephalidae), the type species of *Rhipidocotyle* Diesing, 1907

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ABSTRACT

Rhipidocotyle galeata (Rudolphi, 1819), the type species of the genus, is re-described using material from *Lichia amia* (Linnaeus, 1758) (Actinopterygii, Perciformes) collected from the Gulf of Gabès in the Mediterranean Sea off Tunisia. *Rhipidocotyle galeata* is compared with other nominal species of the genus, including *R. genovi*, *R. minima*, *R. triglae* and *R. viperæ*. This redescription provides additional information about the position and the distribution of the vitelline follicles, which form an arc that does not extend anteriorly past the level of the ovary, an uterus that extends almost to the posterior margin of the rhynchus and an ovary that is positioned adjacent to the anterior testis. A key to the eight *Rhipidocotyle* species from the Mediterranean Sea is presented.

RÉSUMÉ

Redescription de Rhipidocotyle galeata (Rudolphi, 1819) (Digenea, Bucephalidae), l'espèce type de *Rhipidocotyle* Diesing, 1907.

Rhipidocotyle galeata (Rudolphi, 1819), l'espèce type du genre est redécrite en utilisant du matériel de *Lichia amia* (Linnaeus, 1758) (Actinopterygii, Perciformes) collecté dans le golfe de Gabès, sur les côtes tunisiennes de la Méditerranée. *Rhipidocotyle galeata* est comparée avec d'autres espèces du genre, incluant *R. genovi*, *R. minima*, *R. triglae* et *R. viperæ*. Cette redescription fournit d'autres informations sur la position et la distribution des follicules vitellins qui forment un arc ne dépassant pas antérieurement le niveau de l'ovaire, sur l'étendue de l'utérus jusqu'au rhynchus et sur la position de l'ovaire à côté du testicule antérieur. Une clé des huit espèces du genre *Rhipidocotyle* de la Méditerranée est présentée.

KEY WORDS

Rhipidocotyle galeata,
Digenea,
Bucephalidae,
Carangidae,
Lichia amia,
Gulf of Gabès,
Tunisia.

MOTS CLÉS

Rhipidocotyle galeata,
Digenea,
Bucephalidae,
Carangidae,
Lichia amia,
golfe de Gabès,
Tunisie.

INTRODUCTION

The Bucephalidae Poche, 1907 is a major family of digenean, with a wide host and geographic distribution. Members of the genus *Rhipidocotyle* Diesing, 1907 have a pretesticular ovary and a rhynchus that consists of a simple sucker with a dorsal hood or lobe; some species have additional lateral lobes, such as *R. genovi* Dimitrov, Kostadinova & Gibson, 1996 (Dimitrov *et al.* 1996) and *R. capitata* (Linton, 1940) (Bartoli & Bray 2005). Overstreet & Curran (2002) pointed out that the type species is now recognized as *R. galeata* (Rudolphi, 1819), as ruled by the International Commission on Zoological Nomenclature (Smith 2001). This species was originally described by Rudolphi (1819), who reported it from *Centronoti glauci* (probably *Campogramme glycos* (Lacépède, 1801) [Actinopterygii, Perciformes]) off Naples. Stossich (1887) reported *R. galeata* in *Lichia amia* (Linnaeus, 1758) from the Adriatic Sea. The only indication of *R. galeata* appearance is Eckmann's (1932) description and illustration of Rudolphi's original worms. However, her description is brief and lacks in some detail, such as the position and the distribution of the vitelline follicles, the distribution of the uterus and the structure of terminal genitalia. Bartoli *et al.* (2006) considered that *R. galeata* is a poorly known parasite species of carangids in need of redescription.

During a parasitological survey of fishes from the Gulf of Gabès (Tunisian coast), we found a *Rhipidocotyle* species in the intestine of *Lichia amia*, identified as *R. galeata* after the description and the figure of Eckmann (1932). In the present paper, we offer a redescription of *R. galeata*.

MATERIAL AND METHODS

Seven specimens of *Lichia amia* were caught in the Gulf of Gabès by bottom trawlers at Skhira (34°05'N; 10°01'E) (six specimens) and Kerkennah (34°45'N; 11°17'E) (one specimen). Fishes were dissected upon death and examined for digeneans. Living parasites were partially compressed beneath slide and coverslip and examined using an optical microscope.

Some parasites were slightly compressed between a slide and coverslip and fixed with 70% alcohol. Living specimens were washed in cold saline then fixed in hot saline and preserved in 5% formalin. All fixed specimens were stained with Semichon's acetic carmine. After dehydration using a graded ethanol series, the parasites were cleared in clove oil and mounted in Canada balsam.

Drawings were made using a light microscope equipped with a drawing tube and then scanned and redrawn on a computer with Corel Draw Software. Measurements are given in micrometers as the mean followed by the range.

SYSTEMATICS

Family BUCEPHALIDAE Poche, 1907
Subfamily BUCEPHALINAE Poche, 1907

Genus *Rhipidocotyle* Diesing, 1907

DIAGNOSIS. — Body covered with minute spines. Rhynchus simple, sucker-like, with dorsal hood; hood with or without associated lateral and/or frontal fleshy lobes. Mouth posterior to mid-body. Caecum sac-like, variably oriented from pharynx. Testes oblique or tandem. Seminal vesicle spherical to ovoid. Pars prostatica curved, never straight. Ovary pretesticular or lateral to anterior testis. Vitellarium in two fields, anterior to ovary or forming a contiguous arc at level of ovary. Excretory vesicle variable in length. In freshwater and marine fishes.

Rhipidocotyle galeata
(Rudolphi, 1819)
(Figs 1; 2)

Gasterostomum galeatum Rudolphi, 1819.

TYPE MATERIAL. — Muséum national d'Histoire naturelle, Paris, No. HEL 174 (Tf 195) and HEL 175 (Tf 196).

TYPE HOST. — *Centronoti glauci* (as *Campogramme glycos* (Lacépède, 1801) [Actinopterygii, Perciformes]).

TYPE LOCALITY. — Naples.

OTHER MATERIAL EXAMINED. — **Tunisia.** Off Skhira, 34°05'N; 10°01'E, whole-mounts of 12 stained and 3 live specimens, on *Lichia amia* (Linnaeus, 1758) (leerfish [Actinopterygii, Perciformes]). — Off Kerkennah, 34°

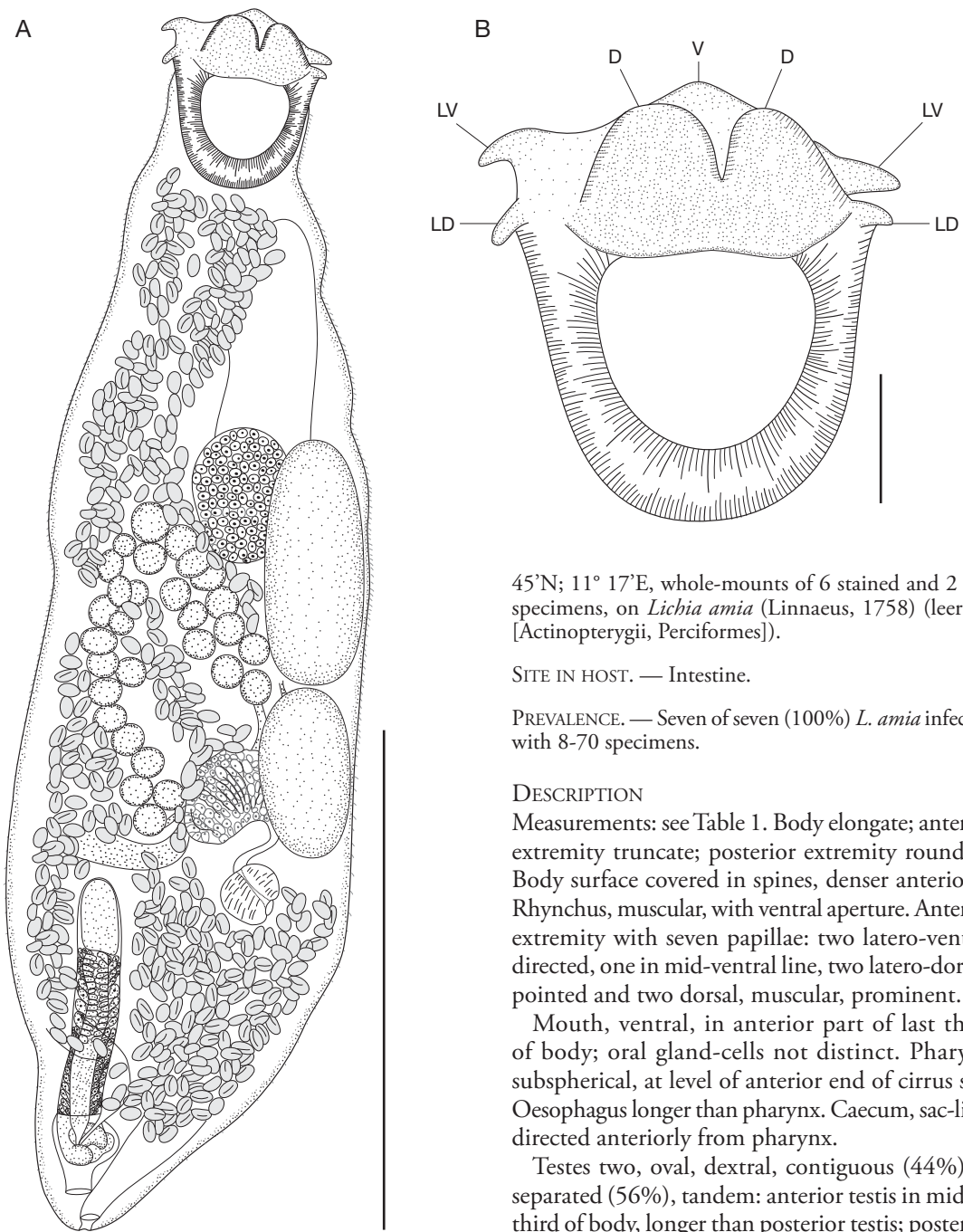


FIG. 1. — *Rhipidocotyle galeata* (Rudolphi, 1819) from *Lichia amia*: **A**, general morphology, dorsal view; **B**, rhynchus, dorsal view. Abbreviations: **D**, dorsal papillae; **LD**, latero-dorsal papillae; **LV**, latero-ventral papillae; **V**, ventral papillae. Scale bars: A, 500 μ m; B, 50 μ m.

45°N; 11° 17'E, whole-mounts of 6 stained and 2 live specimens, on *Lichia amia* (Linnaeus, 1758) (leerfish [Actinopterygii, Perciformes]).

SITE IN HOST. — Intestine.

PREVALENCE. — Seven of seven (100%) *L. amia* infected with 8-70 specimens.

DESCRIPTION

Measurements: see Table 1. Body elongate; anterior extremity truncate; posterior extremity rounded. Body surface covered in spines, denser anteriorly. Rhynchus, muscular, with ventral aperture. Anterior extremity with seven papillae: two latero-ventral directed, one in mid-ventral line, two latero-dorsal, pointed and two dorsal, muscular, prominent.

Mouth, ventral, in anterior part of last third of body; oral gland-cells not distinct. Pharynx subspherical, at level of anterior end of cirrus sac. Oesophagus longer than pharynx. Caecum, sac-like, directed anteriorly from pharynx.

Testes two, oval, dextral, contiguous (44%) or separated (56%), tandem: anterior testis in middle third of body, longer than posterior testis; posterior testis post-equatorial. Cirrus-sac conspicuous, cylindrical, thin-walled, rectilinear or slightly curved, sinistral, extending to level of posterior testis. Seminal vesicle, ovoid. Pars prostatica cylindrical, lined

by thick layer of anuclear structures, surrounded by prostatic cells. Ejaculatory duct passing through distal extremity of cirrus-sac within genital lobe; distal ejaculatory opens at last third of genital lobe. Genital lobe with irregular expansions, projects into genital atrium. Genital atrium, wide, thin-walled, consisting of one chamber; surrounded by small gland-cells. Genital pore ventral, subterminal.

Ovary spherical to ovoid, entire, lateral (78%) or anterior (22%) to anterior testis. Oviduct, directed posteriorly. Laurer's canal thin-walled, rectilinear, post-ovarian, opening on dorsal surface anterior to cirrus-sac. Uterus extends anteriorly to gonads, just posterior to rhynchus, not extending posterior to genital pore, contains sperm proximally. Uterine seminal receptacle present. Eggs operculate. Vitelline follicles in confluent arc, lateral or posterior to ovary, sinistral, longer sinistral field. Vitelline duct joins oviduct laterally or posteriorly to oötype.

Excretory vesicle large, I-shaped, extending to rhynchus. Excretory pore terminal.

DISCUSSION

The description and the measurements of *Rhipidocotyle galeata* given in the present study are in close agreement with those of Eckmann (1932). This description was incomplete with a schematic figure in lateral view. The *Rhipidocotyle* specimens identified as *R. galeata* are usually represented only by records without a detailed description and good illustration (Bartoli *et al.* 2006). The morphological features characteristic of this species include an anterior sucker with seven prominent papillae, an ovary positioned laterally to the anterior testis, a long excretory vesicle, the mouth in the posterior of the body and vitelline follicles in a confluent arc, sinistral to the median body line and which do not pass anteriorly to the ovary. *Rhipidocotyle galeata* has many similarities with *R. genovi* reported from *Gaidropsarus mediterraneus* (Linnaeus, 1758) (Actinopterygii, Gadiformes) in the Black Sea, but it can be distinguished by the longer body (1306 µm vs. 531 µm), anterior testis (248 µm vs. 79 µm), posterior testis (205 µm vs. 76 µm), ovary (138 µm vs. 60 µm) and eggs (25 µm vs. 23 µm).

Eckmann (1932) synonymized *R. galeata* with *R. minima* (Wagner, 1852), *R. triglae* (Van Beneden, 1870) *sensu* Nicoll (1909) and *R. viperae* (Van Beneden, 1870) *sensu* Nicoll (1914). *Rhipidocotyle galeata* differs from *R. minima*, which was re-described by Bartoli *et al.* (2006) from triglid fishes off Great Britain, in having vitelline follicles in a confluent arc in the sinistral portion of the body that do not pass anteriorly to the ovary and an ovary lateral to the anterior testis. In contrast *R. minima* possesses vitelline follicles in two lateral rows, anterior to the gonads and an ovary positioned anterior to the testis.

Rhipidocotyle triglae was re-described from triglid fishes in the Mediterranean by Bartoli *et al.* (2006). This species differs from *R. galeata* in possessing a short excretory vesicle that reaches to the pharynx and vitelline follicles that form two regular rows on either side of the body anteriorly.

Rhipidocotyle viperae was re-described from *Echiichthys vipera* (Cuvier, 1829) (Actinopterygii, Perciformes) off Great Britain by Bartoli *et al.* (2006). It differs from *R. galeata* having vitelline follicles that form two lateral rows anterior to the gonads and an excretory vesicle that reaches the vitelline follicles, rather than extending to the rhynchus as in *R. galeata*.

Bray & Palm (2009) described two new species of *Rhipidocotyle* from the coast of Indonesia: *R. danai* Bray & Palm, 2009 and *R. jayai* Bray & Palm, 2009. These species differ from *R. galeata* by the distribution of the vitelline follicles which are in two lateral fields anterior to the ovary rather than in a confluent arc not passing anteriorly to the ovary and the position of the pharynx anterior to the gonads rather than at level of the anterior end of cirrus sac.

Rhipidocotyle galeata was reported from *Lichia amia* in the Mediterranean Sea (Stossich 1887; present study). Fischthal (1980, 1982) reported *Bucephalus margaritae* (Ozaki & Ishibashi, 1934) from *Lichia amia* and *Trachinotus ovatus* (Linnaeus, 1758) (Actinopterygii, Perciformes) in the Mediterranean Sea. In this study, we found *B. margaritae* in *T. ovatus* from Chebba (35°13'N; 11°08'E) (Gulf of Gabès). However, no *B. margaritae* has been reported from our sample of *Lichia amia*. *Rhipidocotyle galeata* is distinguished from *B. margaritae* by the rhynchus with seven papillae rather than seven tentacles and

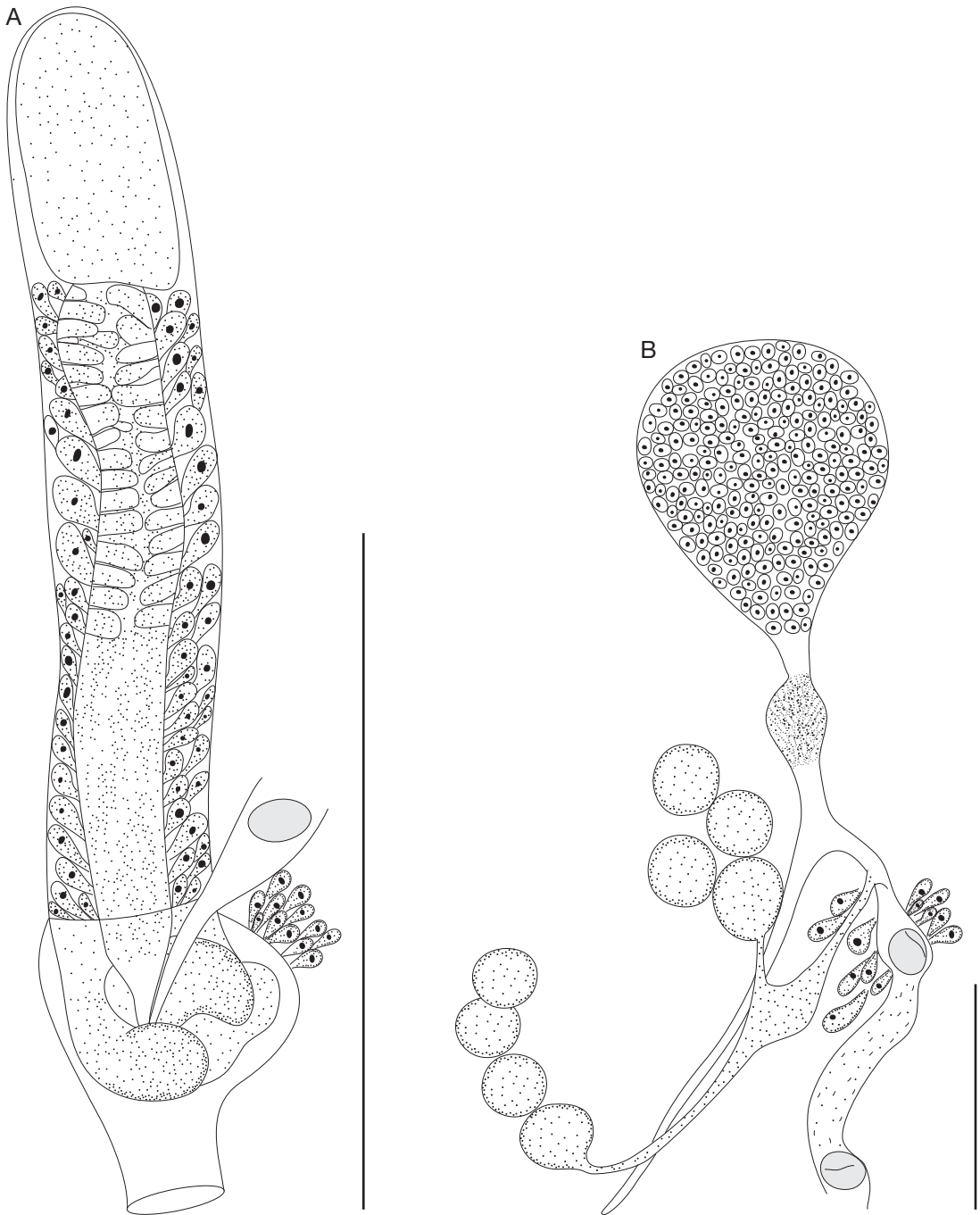


FIG. 2. — *Rhipidocotyle galeata* (Rudolphi, 1819) from *Lichia amia* (Linnaeus, 1758): **A**, dorsal view of terminal genitalia; **B**, proximal female genitalia (dorsal view). Scale bars: A, 200 μ m; B, 100 μ m.

TABLE 1. — Measurements (in μm) of specimens of *Rhipidocotyle galeata* (Rudolphi, 1819) from off the Gulf of Gabès. Host species *Lichia amia* (Linnaeus, 1758). Sample size = 15. *, as % of body length.

Body length	1306 (1000-1650)
Body width	329 (250-390)
From anterior extremity of body to:	
Anterior uterine loops	207 (120-320)
Anterior limit of vitellarium	483 (280-660)
Mouth	829 (610-1120)
Ovary	410 (270-530)
Anterior testis	412 (180-520)
Number of vitelline follicles	27 (24-30)
Diameter of vitelline follicles	41 (35-50)
From pharynx to posterior extremity of body	454 (300-640)
Post-testicular space	433 (290-600)
Rhynchus	173 (130-220) \times 145 (110-200)
Pharynx	54 (50-70) \times 61 (40-70)
Oesophagus	108 (70-170)
Digestive caecum	148 (110-180) \times 108 (60-130)
Anterior testis	248 (150-320) \times 123 (65-150)
Posterior testis	205 (130-320) \times 124 (90-150)
Ovary	138 (120-180) \times 109 (80-120)
Cirrus-sac	363 (290-390) \times 58 (50-70)
Seminal vesicle	101 (62-120) \times 58 (40-70)
Pars prostatica	171 (80-220) \times 26 (20-30)
Genital atrium	79 (40-25) \times 66 (60-80)
Eggs	25 (21-30) \times 14 (11-15)
Body width*	25.8 (15.2-37.3)
Space anterior to pharynx*	63.7 (57-69)
Pre-vitelline field*	37.8 (17-55)
Cirrus-sac length*	28.1 (21.8-37.3)
Post-testicular region*	33.8 (20.7-52)
Pre-mouth distance*	62.8 (43.5-83.6)
Rhynchus/pharynx length ratio	1/0.3 (1/0.2-0.4)

the distribution and the position of vitelline follicles. It is probable that the bucephalid species collected by Fischthal (1980, 1982) from *L. amia* in the Mediterranean Sea and identified as *B. margaritae* corresponds to *R. galeata*. The same author reported *R. galeata* from *Trachinus draco* (Linnaeus, 1758) (Actinopterygii, Perciformes) (Fischthal, 1980).

Judging by Bartoli *et al.* (2006), this species could be *R. viperae*, a parasite of trachinid fish hosts.

Eight species of *Rhipidocotyle* are currently known from marine fishes of the Mediterranean Sea. Identification of specimens is often problematic (Bartoli *et al.* 2006); therefore, a key to the species of *Rhipidocotyle* from the Mediterranean Sea is presented.

KEY TO THE *RHIPIDOCOTYLE* SPECIES FROM MEDITERRANEAN SEA

1. Vitelline follicles in two lateral fields anterior to gonads 2
 - Vitelline follicles forming an arc in the sinistral part of body; not passing anteriorly to level of ovary 7
2. Caecum directed anteriorly from pharynx 3
 - Caecum directed posteriorly from pharynx 6
3. Rhynchus devoid of dorsal hood; vitelline follicles at anterior extremity of posterior half of body *R. longicirrus*

- Rhynchus with dorsal hood or lobes; vitelline follicles located anteriorly in body 4
- 4. Dorsal hood with seven prominences; not separated from body by furrow *R. minima*
- Dorsal hood more or less lobed; separated from body by furrow 5
- 5. Excretory vesicle extending well anterior to pharynx; dorsal hood lobed with two pointed processes on each side bearing spines; cirrus sac reaching the pharynx *R. viperae*
- Excretory vesicle reaching level of pharynx; anterior extremity of hood unarmed; ventral extremity of hood slightly lobed, not pointed; cirrus sac reaching posterior testis *R. triglae*
- 6. Hood pentagonal *R. pentagonum*
- Hood horseshoe-shaped, ventral aspect with two extremities bearing distinct lobes *R. capitata*
- 7. Proximal extremity of cirrus sac at level of mid body; uterine loops extending anteriorly to anterior testis level; body length 448-627 μm *R. genovi*
- Proximal part of cirrus sac more posterior to mid body; uterine loops extending anteriorly to posterior margin of rhynchus; body length 1000-1650 μm *R. galeata*

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